Executive Summary

1 Introduction, Mandates, and Statement of Mission

Contents: The legislative mandates, agency mission statements, and other foundations for DCR's land management program. Also included are a general overview of this management plan, its relationship to past MDC/DWM plans and future DCR/DWSP plans, and a description of the planning process.

Key Points:

Chapter 372 (Acts of 1984) provided the primary legislative mandate for the Metropolitan District Commission's land management activity. Chapter 372 established the Division of Watershed Management and directed it to "…utilize and conserve…water and other natural resources in order to protect, preserve and enhance the environment of the Commonwealth and to assure the availability of pure water for future generations." This statute sets forth clear authority for the active management of the watershed and its natural resources. Chapter 372 directs the MDC/DWM to periodically prepare watershed management plans for "…forestry, water yield enhancement and recreational activities."

On June 30, 2003, Governor Romney signed legislation merging the Metropolitan District Commission (MDC) and the Department of Environmental Management (DEM) into the new Department of Conservation and Recreation (DCR). Since July 1, 2003, The Department of Conservation and Recreation / Division of Water Supply Protection (DCR/DWSP) has assumed the MDC/DWM responsibilities mandated by Chapter 372.

The Ware River Watershed Land Management Plan 2003-2012 calls for the maintenance of a diverse, multi-layered forest cover on much of the watershed. The plan primarily focuses on management over the next ten years, but it also projects the forest cover and watershed conditions 60 years into the future. This plan should be viewed as an "adaptive watershed management plan" to be applied but updated and modified as new properties are added and new information becomes available.

Public input is an important component in the effective management of DCR/DWSP properties; it is sought throughout the planning process. In addition, a volunteer group of scientific and technical advisors provide their expertise to the DCR/DWSP.

2 Background: Ware River Watershed

Contents: A broad overview of the physical characteristics of the Ware River watershed, including the land use history of this area and its impact on the present landscape.

Key Points:

The Ware River Watershed lies in the Central Uplands in north central Massachusetts, and is characterized by rolling hills separated by broad river valleys. The watershed above the Intake Works at Shaft #8 covers 96.8 square miles, or 61,952 acres. It encompasses parts of eight towns: Barre, Hubbardston, Oakham, Phillipston, Princeton, Rutland, Templeton and Westminster. The Department of Conservation and Recreation, Division of Water Supply Protection controls 23,694 acres of Commonwealth-owned land in the Ware River watershed. The Commonwealth holds Conservation Restrictions (CRs) on an additional 787 acres.

Bedrock of the Ware River watershed consists of high-grade complexly folded metamorphic rock heavily intruded by pegmatite. The bedrock is separated into three formations: Partridge Formation, Paxton Formation, and Littleton Formation. Exposure of the bedrock is limited because it is veneered by glacial drift consisting of till and outwash.

Ware River soils have been grouped into five classes for the purpose of watershed management, based upon soil depth and drainage characteristics: Excessively Drained Soils, Well Drained Thin Soils, Well Drained Thick Soils, Moderately Well Drained Soils, and Poorly to Very Poorly Drained Soils.

The average annual stream flow recorded at Shaft #8 and the weir below has been 39.3 billion gallons, or 53% of the average annual precipitation (MDC/MWRA records). At the Intake Works, the Ware River is a 4th order stream formed by the convergence of seven major tributaries which travel a total of about 77 miles to the Intake Works. Sixteen ponds scattered over the watershed range in size from about 30 acres to over 100 acres. The DCR controls the entire shoreline on four of these, and part of the shoreline on an additional five ponds. Wetlands account for more than 3,500 acres on DCR/DWSP lands in the Ware River watershed. They include coniferous and deciduous wetlands as well as those dominated by shrub and herbaceous cover. Over the past decade there has been a shift from forested wetlands to shrub and open wetlands as a direct result of an increase in beaver activity.

European settlement of the region began in 1715, and within a century most of the pre-existing forest had been cleared for agricultural purposes. Since the 1830s, most of this agricultural land has been abandoned, resulting in a steady conversion from open agricultural habitat to forest cover, first dominated by white pine, and then, following broad-scale harvesting of the pine, mixed hardwoods and pine.

This region has experienced significant population growth in the past 20-30 years and consequently continues to be subdivided and developed for residential and commercial use. Average private ownership parcel size has decreased steadily as a result.

The forest that presently covers most of the Division holdings at the Ware River is a product of: 1) natural succession following agricultural abandonment, 2) heavy cutting (mostly white pine) 60-100 years ago and 3) MDC forest management activities over the past 30 years. The legacy of both social and environmental factors is apparent in the forest as it exists today.

3 Water Resources

Contents: An historical perspective on water resources in the Ware River watershed, a description of the Ware River Intake Works, and information on the surface waters and water yield and quality.

Key Points:

Chapter 321 of the Acts of 1927 authorized construction of the Quabbin Reservoir and the Ware River intake. The Intake Works and the Coldbrook-Wachusett aqueduct were completed in 1931. In that initial year, approximately thirteen billion gallons of water were diverted from the Ware River to the Wachusett Reservoir.

The impoundment at Roger Lonergan Intake at Shaft No. 8 in Barre is classified as a “run of the river reservoir.” Residence time is short and the water derives its character from water inputs including Barre Falls Dam, the Burnshirt River, Natty Pond Brook, and Parker Brook, as well as subsurface flow and small amounts of direct overland runoff from impervious surfaces. Each of these inputs contributes

markedly different qualities to the water at the Intake. Besides the impoundment at the Intake, the DCR owns or controls many small dammed ponds that were originally built to provide power for mills.

The Intake Works at Shaft No. 8 are a siphon system. Water is drawn from above the dam into the Works through six siphon spillways. From the spillways the water enters the valve pit where four butterfly valves are mounted to regulate the amount of water entering the shaft. The large metered valve has a capacity of 620 million gallons daily, while each of the three unmetered valves has capacity of slightly less than 600 million gallons a day. The total capacity is slightly less than 2.4 billion gallons daily. The valves direct the water onto cast iron plates with helical vanes mounted on the walls of the shaft. Centrifugal force maintains a smooth discharge of water from the valves around the circumference of the shaft. The water can then be gravity-fed through the aqueduct to either the Quabbin or Wachusett Reservoir. Diversion normally goes to Quabbin, where a baffle dam forces the highly organic water diverted from the Ware River to flow around Mt. Zion, being mixed and stored with the less organic water of the Swift River before leaving Quabbin Reservoir.

Legal restrictions governing diversion of water from the Ware River require that:

- No water may be diverted from the Ware River on any day when the natural flow of the river is less than eighty-five million gallons.
- A total of eighty-five million gallons of water must be released down the Ware River on each day during which diversion takes place.
- No diversion shall take place during the period between May 31 and December 1 in any year unless such diversion is first approved by the State Department of Public Health.

While water quality considerations will drive management decisions for this 2003-2012 Ware River Land Management Plan, both water quality and water yield will remain important considerations in land management planning.

4 Land Protection

Contents: A quantification of protected land ownership within the Ware River watershed. Also a description of DCR/DWSP assistance in the protection of privately-owned and community-owned land, including Conservation Restrictions and Payments In Lieu of Taxes (PILOT).

The DCR/DWSP-owned lands on the Ware River watershed are placed in the context of the entire DCR watershed system. Protection of DCR/DWSP-owned land is detailed, including boundaries, fire, roads, transfers, rights-of-way, disposition, and acquisition.

Key Points:

DCR controls approximately 23,694 acres, or 38.2%, of the Ware River watershed above Shaft 8. There is a long history of cooperation among those agencies concerned with the Ware River watershed, including the Division of Fisheries and Wildlife, the Army Corps of Engineers, and the MA Department of Environmental Management (now the DCR Division of State Parks and Recreation).

There are approximately 125 miles of DCR/DWSP boundary on the Ware River watershed, most traversing remote areas between paved roads. Boundary encroachments on DCR/DWSP property include destruction of property, impairment of water and soil, and construction. Maintained, visible boundaries protect the integrity of property, provide a frame of reference for policing and monitoring, and are

essential proof when a dispute or encroachment occurs. Due to current staffing considerations, the Division is considering contracting out boundary maintenance, or using seasonal employees for this work. In either case, the Division engineering staff would have responsibility for supervision of boundary maintenance.

The number of MDC (now DCR) Rangers assigned to the Quabbin/Ware River watersheds has grown since 1996 from one to seven. Ranger patrols include pro-active surveillance of DCR/DWSP-controlled lands with emphasis on popular access locations around the Ware River watershed. Presently, Watershed Rangers spend an average of 16-20 hours per week covering responsibilities on the Ware River watershed.

The DCR has care and control of approximately 57 miles of gravel access road on the Ware River watershed, as well as numerous miles of non-gravel road. The objectives of road maintenance on DCR watershed lands are to provide for vehicle access to support key watershed management activities, and to minimize adverse water quality impacts associated with this road system. Activities that are dependent upon a good access road system include fire protection, forest management, water sampling, research, and ranger patrols. These activities require stable, properly shaped and ditched road surfaces with adequate structures to manage stormwater. Some DCR/DWSP roads at Ware River are experiencing more traffic than they are capable of handling without deterioration. The Division intends to reduce unofficial use of its roads to a level that can be sustained by current maintenance staff and equipment.

The DCR fire policy, in conjunction with better coordination between DCR, the Division of State Parks Recreation, and local fire departments, has improved fire response time and suppression efforts. DCR provides assistance to the local fire departments as directed by the local fire chief, usually for "mop up" operations. At present, twenty-three DCR employees are certified and available to participate in fire suppression operations. Improvements in fire suppression have been aided by the acquisition of new fire fighting apparatus and at the Ware River by improvements in gravel access roads and by controlling public vehicle access through installation of security gates, thereby reducing the threat of ignition by recreational users.

The MDC acquired 3,255 acres (2,715 in fee & 540 in conservation restrictions) on the Ware River watershed between 1985 and June 2003, bringing the total holdings to 23,694 acres (including 787 acres in CRs), or 38.2% (up from 31.3% in 1985) of the watershed. Expenditures for this acreage total $12.3 million. Funding for the watershed land acquisition program has come from the 1983 Open Space Bond ($3 million), the 1987 Open Space Bond ($30 million), and the Watershed Protection Act of 1992 ($135 million). Approximately $15 million remains available for land purchases ($3 million per year through 2008) within the watershed system. Most of these funds will be spent purchasing land on the Wachusett watershed, which is the least protected basin, with 26% under Division control. Future Ware River watershed land acquisition efforts will focus primarily on the Burnshirt and Canesto River subwatersheds, and Natty Pond Brook subwatershed.

Conservation restrictions constitute a partial acquisition of rights to land ownership, usually in the form of development restrictions. In these cases, the DCR agrees to acquire limited rights to property and to record these rights as an attachment to a landowner’s deed. The landowner remains the owner and retains all rights to ownership except those described in the easement. Any easement acquired by the DCR for watershed protection must help insure the maintenance of a pure public drinking water supply. To this end, it is the policy of this agency to expend funds for the purchase of conservation easements only on acreage with uses, both present and projected, that do not conflict with this goal.

MGL Ch. 59, §5G requires the Commonwealth to make Payments In Lieu of Taxes (PILOT) on properties acquired for watershed protection. This law took effect for Ware River watershed lands in

1987. The state lands revaluation concluded in June 2000 by the Department of Revenue placed the value of Division-controlled property in Ware River watershed communities at $51 million, 80% greater than the 1995 valuation. This increase, which took effect with the FY2001 PILOT, reflects both the additions in Division land ownership (particularly of valuable "prime lots" that could have been developed) and the rise in property values throughout the watershed. The PILOT program, starting in FY2001, annually distributes a minimum of approximately $725,000 to the Ware River watershed communities.

The DWSP seeks common ground on resource protection issues by working with watershed area officials and citizens, since combined efforts help protect both local resources and the metropolitan Boston water supply. The technical assistance programs emphasize local source protection and its immediate impact to watershed residents and decision-makers. Through a cooperative approach, the DWSP improves land-use planning, control of development, and general environmental protection at the local level.

The DWSP Private Lands Stewardship Program encourages private landowners to manage their forests and wildlife to meet watershed-wide goals, looking beyond their individual property boundaries and designing management strategies that address the issues of the larger ecosystem. As of May 2003, 65 private properties totaling 4,556 acres had completed 10-year forest management plans with assistance from this program. Thirteen of these properties are located within the Ware River watershed, totaling 803 acres. The average cost to the Division to provide watershed protection through private land management plans is approximately $12 per acre.

5 Management of Forested Lands Controlled by DCR

Contents: An extensive description of the past, present, and planned management of DCR forests on the Ware River watershed. Division goals and objectives for forest management on the Ware River watershed are described in detail, as are the silvicultural practices chosen to address Ware River forest management objectives. The implementation of a three-strategy approach to forest management on the Ware River watershed is defined and evaluated. Conservation Management Practices (CMPs) designed to protect water supplies are described.

Key Points:

The Metropolitan District Commission purchased the major portion of its present holdings on the Ware River watershed, for the purpose of drinking water supply protection, between 1927 and 1940. At the time of purchase, land use/land cover in the area was a combination of active agricultural land, abandoned fields, and forest land. Approximately 1,700 acres were planted to white, red, and Scotch pine, Norway and white spruce, and European larch between 1931 and 1945. The first harvest operations conducted on Commission-controlled lands were salvage operations of timber damaged by the hurricane of 1938. Continuous Forest Inventory (CFI) plots were established at the Ware River watershed in 1962 by MDC Forest and Park Supervisor Fred Hunt, who established the first CFI plots at Quabbin Reservoir in 1960. The first formal forest management plan for the Ware River was written by MDC Forester Stephen Drawbridge in 1983. Between 1978 and the present, several thousand acres of low quality pasture pine stands have either been regenerated to mixed oak/pine and oak/hardwood stands, via overstory removal cuts, or left as pine stands but improved by cutting the least vigorous or most poorly-formed trees. The improved vigor, increased oak component, and greater age and species diversity have collectively made the watershed forest more resistant to and resilient.

Nearly all of the uplands controlled by the Division on the Ware River watershed are forested, with the remainder in field. The current forest on Division lands on the Ware River watershed is made up

of a range of low to high quality stands, both managed and unmanaged, with an abundance of forest regeneration. Ninety-four percent of the forest is more than sixty years old, and sixty percent is over eighty years old. Some older stands also have an age class that originated with the hurricane of 1938, making them two-aged. A small portion of the forest area is comprised of plantations, established by MDC personnel in the 1930s and 1940s. White, red, and Scotch pine, Norway and white spruce, and European larch were planted as monocultures or in various mixtures. Most of these plantations have been converted to open land or regenerated to natural stands. The largest portion of the forest originated from agricultural lands abandoned in the late 1800s and early 1900s. These developed as understocked white pine stands ("old field white pine") that matured into low quality mixtures of pine and hardwood. Most are even-aged stands, but in some there is a remnant of trees that were present in the original pasture or trees that regenerated following the 1938 hurricane, giving them a two-aged or multi-aged structure.

The guiding objective for the Division's Ware River silvicultural practices is the creation and maintenance of a watershed protection forest, defined by the Society of American Foresters as "an area, wholly or partly covered with woody growth, managed primarily to regulate stream flow, maintain water quality, minimize erosion, stabilize drifting sand or exert other beneficial forest influences" (SAF, 1983). The silvicultural system chosen for the watershed protection forest at Ware River includes intermediate cuttings, regeneration establishment cuttings, and cuttings to release established regeneration.

While the Ware River is administered as part of the Quabbin Section, it has some unique features that affect land management policy. The absence of a reservoir, limited periodic use of the water, and a prolonged time separation from the consumer has engendered a different land management history, including the accommodation of limited secondary uses. The status of the Ware River as part of the supply system has not changed and the Division continues to choose forest management options that are efficient and provide a high level of water supply protection.

For the period covered by this plan, the principal goals for the management of Division properties on the Ware River watershed are to:

- Provide a vigorous forest cover, diverse in species composition and tree sizes and ages, and therefore able to resist and recover from disturbance and to retain available nutrients.
- Maintain the ability of the forest to regenerate following disturbance.
- Prevent erosion of sediments and nutrients from the watershed forest through carefully applied Conservation Management Practices.
- Provide long-term water quality protection with minimal intervention by developing a vigorous, low-maintenance forest.
- Comply with or exceed all environmental regulations governing forest management activities and water resources protection on Division watershed properties.
- Apply forest management practices that maintain current water yields from the watershed.
- Without compromising primary goals for water quality protection, promote the secondary goals of improving the growth and quality of the forest resource, protecting and enhancing habitat for native wildlife species, and maintaining and enhancing biological diversity.

Because the Division's primary forest management objective is water quality protection, silvicultural treatments are designed to create and maintain vigorous forest cover that both resists and recovers from a wide range of disturbances. Improving the structure and composition of stands will reduce their

susceptibility to disease, insects, and disturbance, creating a low-maintenance, persistent forest cover. In the present management period (2003-2012), treatments are planned to:

- Increase the structural diversity of the forest.
- Establish regeneration as necessary, and release advance regeneration.
- Regenerate approximately 1% of the managed forest annually.
- Replace softwood plantations with diverse mixes of native species.

While MDC's silvicultural practices over the years have produced substantial revenue that currently approaches $1 million annually, revenue production has never been a primary objective of these practices. Within this framework, MDC foresters have been able to practice forestry with equal attention to harvesting and to the protection and enhancement of the resources remaining once the harvest is complete. Over decades of applying these forestry practices, the watershed forests have increased in value, both economically and as protection for the drinking water supply, without compromising their broader ecological functions.

The approach adopted for the management of the forest at the Ware River includes three strategies, which will guide management in different areas. As a group these strategies give Division foresters flexible tools with which to address the primary objective of water quality protection as well as a variety of secondary concerns such as biological diversity and aesthetics. They also match the intensity of the silvicultural practices to the sensitivity of resource areas to these activities. Strategy One will eliminate silvicultural operations in sensitive portions of the forest. Strategy Two will employ appropriate silvicultural treatments in areas where silviculture is limited by regulation, including riparian filters and roadside buffer areas. In Strategy Three, all described types of silviculture will be employed to address a range of management and habitat goals, in which water quality protection is paramount.

The major forest types occurring on the DCR properties on the watershed are described, as well as the silvicultural needs of these types, which will be adjusted according to the overlap between forest type and management strategy for any given stand.

Natural disturbances in a forest occur at virtually all scales of time and area. The uneven-aged forest, with three or more age classes well distributed across the landscape of the Ware River watershed, is considered best able to resist and recover from both large and small scale natural disturbances.

Although the Division does not intend to salvage following every disturbance, salvage activities are important components of watershed maintenance when the disturbance damages large areas of forest, or greatly increases the threat of additional damage. Disturbances in areas that are small, remote, or inaccessible may be left to regenerate on their own, although trees may be planted to enhance recovery of these areas.

The DCR/DWSP's Conservation Management Practices (CMPs) ensure that forest management is conducted in a manner that does not impair water resources or other natural or cultural resources on the watersheds. The Division meets or exceeds the requirements of both the Forest Cutting Practices Act and the Wetlands Protection Act (MGL ch. 132 and 131). Whenever these regulations are revised, DWSP management practices will meet or exceed the revised standards.

The Division has established an annual review procedure for all DCR forest management activities on the Ware River watershed involving DCR staff from supporting disciplines include wildlife

biology, forest planning, water quality and environmental engineering, civil engineering, and cultural resource protection.

6 Wildlife Management

Contents: An overview of the Ware River watershed wildlife community, DCR/DWSP wildlife management goals and objectives, and Conservation Management Practices (CMPs) for wildlife management. A detailed assessment of the anticipated impacts of planned watershed management activities. Section also includes a discussion of wildlife population or impact control plans.

Key Points:

The Ware River watershed supports an impressive variety and abundance of wildlife. DWSP forests provide habitat for a diversity of birds and mammals including moose, white-tailed deer, turkey, grouse, fisher, and bears. Neotropical migratory birds utilize Division forests for breeding and as migratory rest stops. Wetlands support a variety of reptiles, amphibians, and birds. Several multi-acre tracts of early successional non-forested habitat provide habitat for a variety of species dependent on open lands, including eastern meadowlarks, bobolinks, and various insects. Since some towns within the watershed are experiencing tremendous growth, open space is being rapidly converted to residential areas. The protection that Division lands provide to wildlife species may be critical to their long-term survival.

The primary goal of the wildlife program on the Ware River watershed is to protect water quality from negative impacts associated with wildlife. The specific objectives of the wildlife management program are to:

- Mitigate adverse impacts of wildlife on water quality, infrastructure, and other watershed resources.
- Protect uncommon, rare, and otherwise significant wildlife species and habitats wherever they exist on DCR lands.
- Assess and mitigate impacts of watershed management activities on wildlife through a process of notification, site visits, review of records and literature, and recommendations to appropriate management staff.
- Actively manage for selected wildlife species that are considered to be uncommon, rare, or unique on a regional or statewide basis.

Conservation Management Practices (CMPs) for wildlife management include: the identification and protection of all vernal pools, seeps, springs, and surrounding soils; the retention of old apple and other fruit trees when possible; and the preservation of functional wildlife wintering areas. In addition, a variety of mast-producing plants will be maintained and enhanced within the watershed, including both hard mast producers such as oaks and hickories, and soft mast producers such as blueberries and dogwoods. Forestry operations will continue to provide both den and snag trees, deliberately distributed in order to maintain self-sustaining populations of all cavity-dependent wildlife. Downed woody material will be retained or provided in a range of sizes and types. DCR/DWSP will maintain suitable nesting sites for woodland raptors across the landscape over time and will avoid disturbing nesting pairs of raptors.

The planned silvicultural treatments to diversify age and species structure of DCR watershed forests will result in wildlife communities dominated by species adapted to a variety of forested conditions. Those species requiring early successional non-forested habitat will be less common and restricted to those limited areas where this type of habitat exists. Open, non-forested habitat will be maintained on a small percentage of the Division's land on the Ware River watershed. In general, wildlife species adapted to forest cover should benefit the most from the Division's land management plan for its Ware River watershed properties.

While it is the Division's policy not to interfere with natural wildlife activity, when those activities impact either water quality or the integrity of watershed structures or resources, then the Division must take an active role in mitigating those damages. The species of concern on the Ware River watershed and their associated risks are:

- Beaver - can cause damage to watershed structures and property; can negatively impact water quality depending on their location and site conditions
- White-tailed deer - can alter tree species diversity and abundance
- Moose - can alter tree species diversity and abundance

7 Management to Protect the Natural Landscape on DCR Property

Contents: The source of the Division's mandate to protect biodiversity during its management of the Ware River watershed properties and Division goals for meeting that mandate. Rare natural communities, rare fauna, and rare flora on the watershed are described, as well as the threats imposed by invasive species and management approaches for dealing with these threats.

Key Points:

The DCR/DWSP's goals for biodiversity focus on either maintaining or enhancing natural ecosystems across the watershed. The DCR/DWSP recognizes that its greatest contribution to regional biodiversity is protecting large areas of land from development and maintaining most of those lands in forest cover.

The DCR/DWSP's principal goals for maintaining biodiversity are to retain most of these lands in forested condition, to identify and provide habitat for the protection of uncommon and rare flora and fauna, to eliminate and prevent the spread of non-native invasive species, and to provide the range of seral stages from early successional habitat through unmanaged mature forest.

8 Management to Protect Cultural Resources on DCR Property

Contents: Policy with regard to cultural resources and methods for the protection of cultural resources during management activities.

Key Points:

Preservation legislation and DCR's Cultural Resource Management program are designed to ensure that future generations will have the opportunity to understand, appreciate, and learn about the past. DCR seeks to identify and preserve cultural sites and resources on DCR watershed lands.

9 Research, Inventory, and Monitoring Needs

Contents: Research needs in the general areas of forest, wildlife, and cultural resources.

Key Points:

Ten specific research projects have been identified by DCR staff as necessary to improve management efforts on the Ware River watershed.

10 Appendix I: Discussion of Forest Management Approaches

Contents: A detailed literature review on the relationship between various forest management approaches and water yield and quality.

11 Appendix II: Uncommon Plants Potentially Occurring on DCR Properties and Habitats in Which Rare Plant Species are Likely to be Found (Searcy, 1996)

Contents: A copy of portions of a consulting botanist's 1996 report on rare plant occurrences on DCR/DWSP forests.

12 Literature Cited and General References

Contents: The bibliography for this plan includes all literature cited within the body of the plan, as well as other general references that may be of interest to readers.

13 Glossary of Terms

Contents: Terms and definitions used by the DCR throughout the plan are listed alphabetically, with sources included where necessary.